FAO – Forestry Department – Wood Energy

WISDOM – Slovenia

Spatial woodfuel production and consumption analysis
applying the
Woodfuel Integrated Supply / Demand Overview Mapping (WISDOM)
methodology

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Based on:
the work carried out in the framework of the FAO/Government of Slovenia Project “Supply and Utilization of Bioenergy to Promote Sustainable Forest Management” TCP/SVN/2901, and follow-up actions undertaken by the Slovenia Forest Service and Slovenia Forestry Institute

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Foreword

Given the importance of woodfuels in providing energy for both traditional and modern industries, as well as their relevance in forestry, energy and rural development contexts, woody biomass is an important resource that, when sustainably managed, can have positive impacts on the environment, forests, social and economic development.

To promote this process, the Forestry Department of FAO is broadening and disseminating knowledge and information on wood energy aspects and actively collaborating with member countries in the development and implementation of tools supporting wood energy planning and policy formulation.

One such tool is the Woodfuel Integrated Supply/Demand Overview Mapping (WISDOM), a spatially-explicit method for assessing woodfuel sustainability and supporting wood energy planning through the integration and analysis of existing consumption and production-related information.

Within the framework of the Project "Supply and Utilization of Bioenergy to Promote Sustainable Forest Management", TCP/SVN/2901, implemented by the Government of Slovenia and supported by FAO, the WISDOM methodology was applied in order to acquire the knowledge base necessary to formulate national wood energy strategies that would also correspond with the criteria for Slovenia's entry into the European Union.

As on previous occasions, with the integration of spatial and statistical information from various sectors, the WISDOM approach proved to be an efficient way to boost understanding of wood energy and to provide useful elements for the formulation of new strategies.

Prior to project implementation, a holistic approach to the wood energy sector was lacking. Existing information was fragmented and failed to provide a coherent appreciation of the sector's relevance in the context of both forestry and energy. The WISDOM approach allowed for the reconciliation and consolidation of forestry data with data from other sectors, and, with limited additional data collection, produced a coherent vision of the status and potential of wood energy in Slovenia, summarized in the Slovenia Wood Energy Information System (SWEIS). This study brought new awareness of the opportunities offered by wood energy and sharply enhanced the capacities of the Forest Service to cope with the challenges of planning and providing information to stakeholders, as well as the public at large

The value of the WISDOM and SWEIS analyses was evident in the actions undertaken by the Slovenia Forest Service and Slovenia Forestry Institute shortly after project completion. These follow-up actions included the development of a tailored WISDOM analysis for five municipalities interested in developing pellet production and district heating systems; the formulation of a national wood energy strategy within the National Forestry Programme and the National Programme for Rural Development; and the preparation of the Slovenian Wood Biomass internet portal that provides state-of-the-art information on all aspects of wood energy in Slovenia.

Another important outcome of the Project is that the Slovenian Government is now playing a catalytic role in promoting similar activities in other countries of East and Central Europe, alongside regionally coordinated activities proposed by the Forestry Department of FAO. To boost the process, the Slovenian Ministry of Agriculture, Forestry and Food, in collaboration with FAO, hosted an international workshop, "Development of Woody Biomass for Energy in Central and Eastern European Countries", which was held in Bled, Slovenia, in November 2005, with the participation of delegates from twelve countries of the sub-region.

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Summary

Slovenia is a nation rich in forests that cover almost 60% of its land area. The country also has considerable amounts of trees and shrubs on other, non-forest categories of land, especially on abandoned farm lands. Therefore, there is tremendous potential to develop woody biomass as a renewable source of energy. Current forest cutting does not reach half the estimated annual increment leaving this energy resource largely unexploited.

In order to acquire the knowledge base and planning tools necessary for the formulation of a sound bioenergy strategy the Government of Slovenia, supported by FAO, executed the Project "Supply and Utilization of Bioenergy to Promote Sustainable Forest Management", TCP/SVN/2901, implemented between July 2003 and June 2004. This Working Paper summarizes the results and the main methodological features of the Information Component of the project.

The objective of the Information Component was to assist the Slovenian Forest Service (SFS) in strengthening wood energy planning and policy formulation and in developing an adequate spatial and statistical information base. More specifically, the objectives were to develop a series of thematic wood energy maps, following the methodological approach named Woodfuels Integrated Supply/Demand Overview Mapping (WISDOM)[1] and to contribute to the creation of the Slovenia Wood Energy Information System (SWEIS), providing a comprehensive vision of current woodfuel flows and of the potential for bioenergy development.

The activities carried out included the review, harmonization and integration, at the lowest possible administrative level, of all available information related to supply and demand of woodfuels, the spatial representation of supply sources and current fuelwood[2] consumption levels, especially for the household sector where consistent data was lacking. One specific activity concerned the design and implementation of the survey of biomass stocking and productivity of non-forest land uses, such as farmlands, orchards and pastures that are important fuelwood supply sources for which no information existed.

The main output is the Slovenia WISDOM, which includes a geodatabase at the level of Cadastral Community (KO) providing details on current and potential woodfuel production and consumption patterns (and related parameters) and the first versions of the Slovenia Wood Energy Information System (SWEIS), which provides a national-level overview.

WISDOM – Woodfuels Integrated Supply / Demand Overview Mapping

WISDOM is a spatially-explicit method designed to support strategic wood energy planning and policy formulation, through the integration and analysis of existing woodfuel demand and supply related information and indicators.

The Slovenia WISDOM analysis was based on 2696 Cadastral Communities (KO, from Katastrske Občine), which represent the Slovenian territorial structure and a serve as reference for both forestry and demographic statistics. A cartographic layer was added to illustrate the distribution of some 6000 human settlements providing basic demographic data.

The integration and elaboration, at KO level, of data from existing statistics (forestry, census, land use, etc.) and from the new survey on woody biomass outside forests, resulted in a rich data set of over 100 parameters related to woodfuel consumption and supply. In addition, point data allowed the distribution of wood industries, biomass plants, district heating systems and associated parameters.

WISDOM provided a holistic vision of the wood energy sector at the national level and an aggregation of key parameters constituted the main entry of SWEIS. As a planning tool, the main value of WISDOM is in its spatial character. Its fine spatial and thematic resolution makes it a flexible tool for the representation of Slovenia's fuelwood production/consumption situation in different locations and for the definition of priority areas from a variety of perspectives.

[1] Methodology developed by FAO Wood Energy Programme in collaboration with the National Autonomous University of Mexico [7].

[2] Fuelwood is by far the most important type of woodfuel in Slovenia, since charcoal is rather negligible and black liquor is produced and consumed directly by the single paper mill of the country. Therefore, in this paper the term "fuelwood" will be used, rather than "woodfuel", unless otherwise specified.

SWEIS - Slovenia Wood Energy Information System

SWEIS summarizes at national level the production, import, export and consumption of woodfuels over the period 1995 - 2002. SWEIS uses the national-level totals of selected parameters that were developed for WISDOM Slovenia as well as additional data from the Statistical Office of Slovenia and other sources. It includes all data important for planning and designing wood energy policies, and, in the organizational sense, it provides for regular gathering of these data.

Main findings and conclusions

The main Project contributions are: i) the new estimates of woodfuel consumption where the household sector absorbs the largest share, and ii) the first estimation ever done of woody biomass stocking and productivity by land use class in non-forest lands in Slovenia.

Key findings resulting from the elaboration of WISDOM and SWEIS are the following:

- Approximately 1.9 million m^3 (mm^3) of wood was used as an energy source in Slovenia in 2002, of which 1.3 mm^3 was consumed by the household sector and 0.6 mm^3 by the industrial sector, including biomass energy systems. It appears that there are two fairly independent woodfuel circuits: one household circuit that uses fuelwood mainly from forests and farmlands (and marginally charcoal) and one industrial circuit that uses residues mainly from the wood, pulp and paper industries.
- The comparison of these consumption estimates with existing fuelwood production data from SFS Statistics lead to the conclusion that “Fuelwood” reported by the Statistical Office of Slovenia represented only a small fraction (some 20%) of the volumes actually used as fuel. The “official” fuelwood production highlighted the fact that the energy use was not adequately recognized and studied in the national context. This situation had prevented adequate analysis of role of forests in the energy sector as well as the analysis of the share of wood fuels in the national energy mix.

<u>Supply issues</u>

- The Project results suggest that the potential supply of woodfuels could be more than double today’s extracted volumes without limiting the timber industry or affecting the growing stock, considering that:
  - the volume actually extracted from the forest in recent years was only part of the allowable cut (some 60-70%)[3];
  - the allowable cut itself (currently 4 million m3/yr) is less than 60% of the estimated annual increment, which has been steadily increasing from 5.3 million m^3 in 1990 to 7.3 million m^3 in 2003);
  - the forest stocking increased from 207 million m^3 in 1990 to 286 million m^3 in 2003; and
  - over the period 1975-2000, the forest area has been increasing at an annual rate of 0.4% (almost 5000 ha every year) due to abandoned farmland.
- Given the above, a more intense fuelwood production (through thinning, for instance) is not only possible, it is highly recommended since it would be beneficial to forest health conditions, on stands resistance to extreme weather conditions and for the quality of the country’s industrial timber.
- Although it is known that a significant share of fuelwood for household use is collected by farmers in their own non-forest lands, no information had existed before this study on the wood stock and productivity of these areas. The survey of non-forest woody biomass, conducted in the

[3] Of the 4 million m3 of the annual allowable cut, only 2.4 were actually extracted on average during the period 1991-2001. Although in recent years the cut fraction has increased to some 2.8 million m3, the biomass built-up represents a serious threat to the health of Slovenia forests.

framework of the project, produced the first objective estimation of wood stocking and annual increment outside forest areas in Slovenia. The standing volume in non-forest areas (including meadows, abandoned agriculture, agro-forestry, urban areas, orchards, etc.) amounted to some 11.5 million m^3, with an estimated annual increment of some 400 000 m^3. From this resource, approximately 300 000 m^3 are probably used as fuel every year[4].

- Data on wood residues from forest industries was limited and not up-to-date. However, based on best available information, the annual production of wood residues at year 2002 was tentatively estimated at some 553 000 m^3.

Demand issues

- In Slovenia there are two fairly independent woodfuel consumption-production circuits:
  - a "household" circuit that uses mainly fuelwood (and marginally charcoal) from forests and farmlands, and
  - an "industrial" circuit that uses mainly residues from wood industries and paper mills.
- At present, almost all fuelwood consumption in Slovenia is absorbed by the household sector for heating. Fuelwood meets about one third of national energy demand for household heating. In spite of its relevance, reliable statistics on fuelwood consumption did not previously exist. New estimates were produced using 2002 Census data and previous studies on average energy requirements. According to these estimates, almost 1.3 million m^3 of wood were used in 2002 by Slovenian households.
- The information available on industrial wood energy consumption was fragmented and recent data largely incomplete. Based on available references, the consumption of industrial biomass systems was estimated to be approximately 500, 000 m^3 in 2002.

Integration

- Several supply/demand balance scenarios, focusing mainly on the "household" sector, were created and mapped at KO level, considering the current and potential production levels from forests and non-forest areas. These maps, along with other socioeconomic aspects, will be essential in identifying the locations for new wood energy plants, such as those planned by the Slovenian Energy Agency.
- As an example of priority zoning, three identified components that are of particular relevance in future forestry planning of woodfuel production were combined, these are: (i) high surplus of non-timber assortments suitable for energy use; (ii) high fragmentation of forest properties; and (iii) high proportion of forest stands at thinning stage. These areas are critical under the forest management viewpoint. In these areas forest owner associations should be promoted in order to achieve an acceptable profit level for the owners to undertake the needed sylvicultural treatments that are otherwise neglected. In these contexts, energy offers good profit opportunities that benefit both the society and the forest ecosystem.

Impact of WISDOM on policy development

The timeliness of WISDOM analysis was evidenced by the good reception by the Forest Service and by the immediate use made of the geodatabase as well as of the SWEIS overview. In fact, within a few months of the Project's conclusion, the WISDOM Slovenia geodatabase was used for: (i) support and as a basis for local wood energy planning in five municipalities through the development of a tailored WISDOM analysis and (ii) for the definition of a draft national strategy and the inclusion of wood energy components in the National Forestry Programme and in the National Programme for Rural Development, both under preparation.

[4] These values represent the first estimation ever done of non-forest woody biomass. However, since the variance of tree cover outside the forest is extremely high, the margin of error is very wide and they should be considered indicative only.

The WISDOM data set, aggregated at the municipal level, is currently being used as a key ingredient in the preparation of the Slovenian Wood Biomass internet portal that will provide easy access to state-of-the-art information on all aspects of wood energy in Slovenia. A special sector will be dedicated to the ranking of local communities according to suitability for wood energy development under different management perspectives.

As a result of the Project, Slovenia has played catalytic role in promoting similar activities among the countries of East and Central Europe. Such role was performed in the context of a regionally coordinated action promoted by the Forestry Department of FAO, in the two occasions below, where the features of WISDOM and SWEIS were presented and discussed:

- the first working meeting on "Supporting Wood Energy Planning in Eastern Europe", at FAO headquarters in Rome on 16 March 2005, as a side event of the 2005 FAO Committee on Forestry (COFO), attended by representatives of 13 Central and East European countries and 3 international organizations;
- the international workshop, under the title "Development of Woody Biomass for Energy in Central and Eastern European Countries", hosted by the Slovenia Ministry of Agriculture, Forestry and Food in collaboration with FAO, organized by the Slovenia Forest Service and held from 9 to 11 November 2005 in Bled, Slovenia. Delegates from 12 countries participated to the three-day meeting: Estonia, Czech Republic, Romania, Bulgaria, Macedonia, Serbia, Croatia, Hungary, Sweden, Italy, Latvia and Slovenia.

Follow-up

In order to maintain long-term effectiveness of WISDOM and SWEIS as planning tools, it is recommended that Slovenia continue the process of data collection and further develop it. Future data collection should include the following information:

- fuelwood consumption time series data for the household sector, or related indicators; this information will allow for the assessment of consumption trends and the elaboration of possible short-term development scenarios;
- complete data on the production of wood residues by forest industries and on woodfuel consumption and energy production by biomass plants.
- accessibility factors that limit the full exploitation of the country's wood energy potential from a physical, legal and economic perspective.

As mentioned above, the official national statistics on woodfuels are incomplete and do not reflect the true role that wood energy plays in both forestry and energy sectors. This is a major limitation in the development of this sector. It is therefore strongly recommended that the Statistical Office of Slovenia define, in collaboration with forestry and energy authorities, a set of wood energy variables and that specific attention be given to the production and consumption of individual woodfuels in future statistical surveys of both forestry and energy sectors.

Table of contents

Acronyms

CHP	Combined heat and power plant
CUM	Cubic meter (m^3)
CV	Coefficient of variation
DHS	District Heating System
dw	Dwelling
inh	Inhabitant
KO	Katastrske Občine (Cadastral community)
MJ	Megajoules (10^6 joules)
PJ	Petajoules (10^{15} joules)
SFI	Slovenia Forestry Institute
SFS	Slovenia Forestry Service
SWEIS	Slovenia Wood Energy Information System
SWEM	Slovenia Wood Energy Map
TCP	Technical Cooperation Programme of FAO
WISDOM	Woodfuels Integrated Supply/Demand Overview Mapping